



April 5, 2019

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**BRIDGE L3275 REHABILITATION PLAN  
DESIGN EXCEPTIONS**

Final plans are being prepared for Bridge L3275, Old Canada Avenue over the Cannon River. During the planning and design process, a railing study was completed with a goal of the upgrading the railings to meet appropriate guidelines while at the same time diminishing the historic character of the bridge as little as possible. It was agreed that the geometrics of the new pedestrian railing would meet or exceed AASHTO Standards but would not meet the more stringent MnDOT Standards. The following documents the details of the design exceptions as well as the reasons and justifications for the final design:

**DESIGN EXCEPTIONS**

Pedestrian Railing Height:

Design Standards:	AASHTO LRFD Bridge Design Specifications, 13.8.1 MnDOT LRFD Bridge Design Manual, 13.2.2
Design Element Involved:	Pedestrian Rail Height
AASHTO Standard:	42 inches
MnDOT Standard:	54 inches
Existing Railing:	36 inches
Proposed “in lieu of” Design:	48 inches

Pedestrian Railing Openings:

Design Standards:	AASHTO LRFD Bridge Design Specifications, 13.8.1 MnDOT LRFD Bridge Design Manual, 13.2.2
Design Element Involved:	Pedestrian Rail Openings
AASHTO Standard:	6-inch clear openings below 27-inch height and 8-inch clear openings above 27-inch height
MnDOT Standard:	4-inch clear openings below 27-inch height and 6-inch clear openings above 27-inch height
Existing Railing:	15-inch max clear opening
Proposed “in lieu of” Design:	meet AASHTO Standard

## JUSTIFICATION

### Degree to which the standards are is reduced:

The pedestrian railing height is proposed to be 6 inches less than the MnDOT design standard. However, the proposed height is 6 inches more than the AASHTO design standard. The railing opening heights meet the AASHTO design standard and are 2 inches less than the MnDOT design standard.

### Effect on other standards:

Not conforming to these standard does not affect other design standards.

### Safety/Accidents:

The existing railing is not in conformance with AASHTO or MnDOT bridge design standards. The railing elements do not meet the strength required for a pedestrian railing design. The current height of 36 inches does not meet the height requirement for either standard. And, the clear openings in the railings, currently 15 inches, far exceed the maximum allowed opening size. Each of these design standards are in place to protect public safety. MnDOT's more stringent requirements for railing height is to protect bicyclists from falling over the railing and for railing openings is to protect small children from falling through. Although the dimensions of the railing are slightly below the State (MnDOT) standard, they still meet or exceed the National (AAHTO) standard for safety of pedestrian railings.

In 2004, the National Cooperative Highway Research Program (NCHRP) issued a report titled "Determination of Appropriate Railing Heights for Bicyclists." The report mostly compares 42-inch and 54-inch railings. It discusses the origins of the 54-inch recommendation and suggests a lack of solid empirical evidence to support 54 inches. The report analyzes, for example, a bicyclist's center of gravity and its relation to various railing heights, as well as discussing how railing height recommendations may vary depending on whether the bicycle path is straight or curved, whether it is flat or declining, and whether the cyclist would be traveling parallel to the railing or approaching it at an angle. The report states that 54 inches is often undesirable in scenic areas because the rail can seem confining and block views for bicycles and pedestrians. The report concludes that 48 inches might be a good intermediate height to both provide safety and lessen unwanted visual impacts (pg. 34).

### Cost:

The cost between meeting MnDOT design standards and meeting AASHTO design standards is negligible. Meeting MnDOT standards would require additional cables to be incorporated into the railing design.

### Historic Impacts:

Constructed in 1909, Bridge L3275 consists of a 140-foot, steel, riveted and bolted, Camelback through truss on concrete abutments. The Waterford Bridge is listed in the National Register of Historic Places. The bridge is significant as an example of a Camelback through truss with rigid connections. It is one of the earliest extant bridges with rigid (riveted and bolted) connections in Minnesota and is the only known metal through truss bridge in Minnesota featuring a limited number of bolted connections.

For historic bridge rehabilitation projects, it is MnDOT policy to encourage and support, where appropriate, the use of the less stringent standard where there are two or more

competing sets of standards or guidelines. This policy is based on a 2008 Programmatic Agreement (PA) between MnDOT, SHPO, and FHWA that is intended to encourage the preservation of Minnesota's most important historic bridges. The PA encourages design flexibility where appropriate, stating that "FHWA and MnDOT strongly encourages the development of historic bridge projects in a context sensitive manner, including the use of design exceptions and variances when practical."

The recommended replacement of the existing railing with a new railing of simple design in the existing location meets the Secretary of the Interior's (SOI) Rehabilitation Standards. While it requires the loss of some historic fabric, the railings are not considered a character-defining feature. Replacement would allow the railings to be upgraded to meet modern safety standards in a way that preserves the Waterford Bridge's historic character and significance. This recommendation was arrived upon in consultation with Waterford Township, Dakota County, the State Aid Bridge Office, and the Minnesota Department of Natural Resources (MnDNR).

Any significant changes in existing features of the bridge could result in a finding of and "adverse effect" to the historic structure. Thus, the railing was carefully researched/designed and has been reviewed by both the by the State Historic Preservation Office (SHPO) and the Minnesota Historical Society (MHS). SHPO has formally concurred that the entire rehabilitation design, including the railing replacements, will have "no adverse effect" on the historic structure.

#### SUMMARY

Conforming to the State design standard would require the railing to be more pronounced and visually obtrusive than the proposed railing design. This may jeopardize the ability of the railing to conform to the Secretary of the Interior's (SOI) Standards. Meeting SOI Standards is a requirement of the grant funding secured to prepare these bridge rehabilitation plans. Conforming to the National design standards in lieu of the State design standards is considered a necessary trade-off to ensure the project can move forward and meet historic standards.

It is requested that the Township provide a formal response accepting these documented design exceptions.

Please do not hesitate to contact me (218-279-2486) with any questions.

LHB



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c: LHB File 180445